Classroom Composting

Learning Objectives: To have students learn about recycling in nature and actually recycle organic matter by composting.

Subjects: Science, Environmental Education, Family and Consumer Education

Wisconsin Model Academic Standards: SC A.4.5, SC A.8.6, SC C.4.2, SC C.4.4, SC C.4.6, SS D.4.7, SS D.8.11, EE A.4.1-4, EE A.8.3, EE A.8.4; EE C.8.2, EE E.4.2, FCE introductory D.2, D.3.

Grades: 4-8

Materials:

- fish aquarium
- organic waste materials (be sure to add a variety of materials, not all one kind, i.e., use sawdust, wood ash and leaves in addition to food scraps; avoid meat scraps, fats and oils, which inhibit decomposition and in outdoor compost piles can attract dogs, rats, raccoons and other animals)
- lawn fertilizer that contains nitrogen (but not herbicides or insecticides) or manure and green grass clippings that also contain large amounts of nitrogen. Be careful, don't use too much nitrogen—a carbon: nitrogen ratio of 25-30:1 is ideal. (Grass clippings already have a carbon: nitrogen ratio of 19:1, while leaves have a 60:1 ratio.)
- soil
- 1-2 dozen red earthworms (obtain from yard, garden, bait shop or school grounds)
- thermometer
- trowel or large kitchen spoon (for turning, or aerating the pile)

THE PERFECT COMPOST RECIPE

soil: contains microorganisms that help decomposition.

organic wastes: such as leaves, food scraps, grass clippings. Wastes should be varied, including materials with both carbon and nitrogen. By alternating layers of high-carbon and high-nitrogen materials, you can create good environmental conditions for decomposition to occur.

nitrogen: many of the organisms responsible for decomposition need nitrogen, thus nitrogen is necessary for rapid and thorough decomposition. Nitrogen is found naturally in organic wastes (higher in "green" materials like grass clippings than in "brown" materials like dry leaves), and in many commercial fertilizers.

worms: they eat the waste, helping to break it down; make droppings, which enrich the soil; tunnel through and aerate the waste, facilitating decomposition; and eventually die and become part of the compost.

water: necessary for normal functioning of life. Too much water in a compost pile may make it soggy and slow decomposition by reducing needed oxygen.

air: the biological activity of fungi, bacteria, small insects and other organisms results in decomposition. Most biological processes require adequate amounts of oxygen.

time: decomposition takes time. To speed up decomposition, aerate (by turning it over) your pile every few days; otherwise, just leave it and wait.

heat: is produced by chemical reactions resulting from increased biological activity that occurs during decomposition. Heat helps sanitize compost by killing certain organisms (e.g., weed seeds, pathogens, harmful insect larvae).

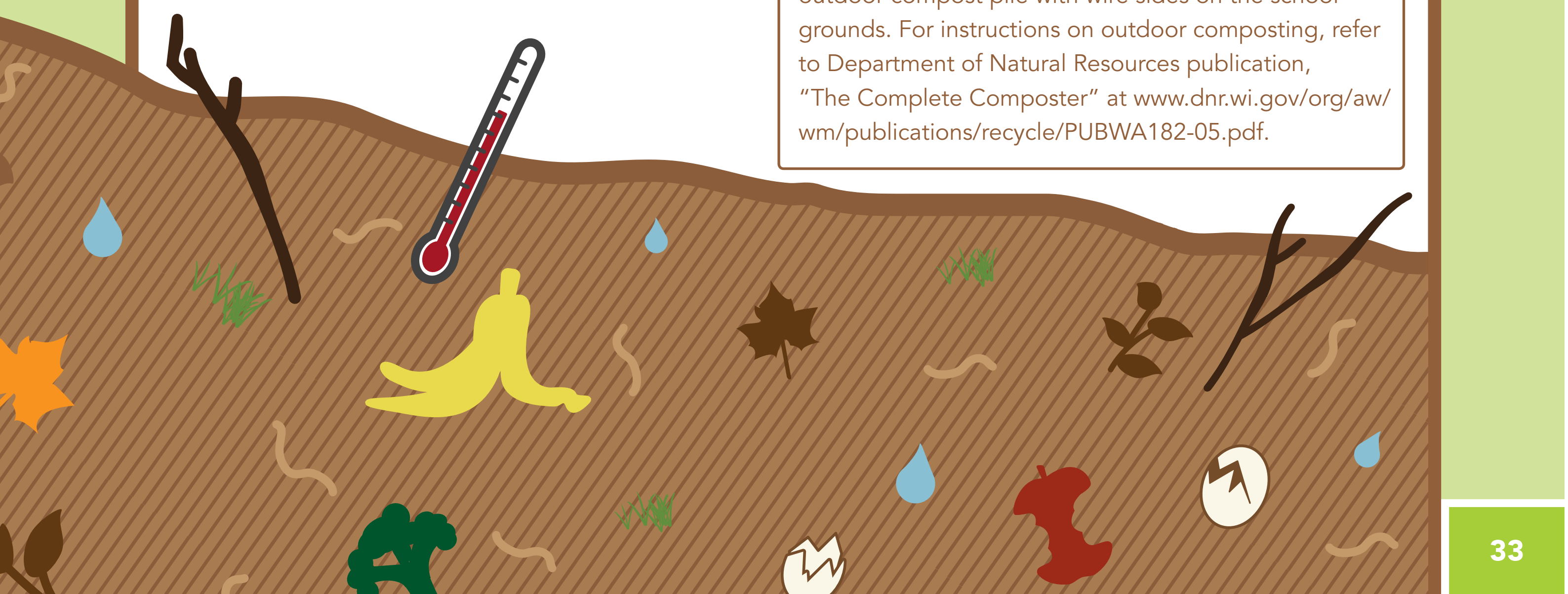
mass: in order to generate enough heat for optimal decomposition, the pile must contain at least one cubic meter of organic material. Thus, the temperatures generated in an aquarium compost pile may be different from those generated in one that is larger.

Procedure:

1. Discuss: What "ingredients" do you think are needed to construct a compost pile? Why? List ingredients.
2. Design a plan for making a mini-compost pile in the classroom. Decide which ingredients the students will provide and which will be supplied by the teacher. Set a date for constructing your pile.
3. Suggestions for creating a mini-compost pile:
   - **a.** Chop the organic wastes into small pieces. You can leave some large pieces of the same materials to compare rates of decomposition between large and small items. Why might there be a difference?
   - **b.** Alternate layers of the materials as follows (amounts are approximate): inch of soil, two inches of organic waste, sprinkle of fertilizer, sprinkle of water, repeat.
   - **c.** Cover with an inch of soil. Water the pile enough to make it moist but not soggy. It should feel like a damp sponge (it feels moist, but you can't squeeze water out of it).
   - **d.** Add the earthworms and observe their behavior.
   - **e.** Place your compost pile where it will be at room temperature (not in direct sun).
4. Place the thermometer in the middle of the pile. Wait an hour or so, then record the temperature.
5. Record the temperature from the same location and depth, and at the same time each day. Why is it a good idea to be consistent with location, depth and time of recording? Does the temperature change? Why or why not? Make a graph to show your temperature results.
6. Gently mix the compost once a week to aerate it. A good time to turn the compost is after the temperature peaks and begins to drop. Why? Be sure to record the temperature before you turn the compost that day.
7. Be patient. Occasionally check the moisture and add water if needed.
8. Make a chart to help you keep a daily record of temperature and other observations during the next month or two.

* *Procedure instructions continued on next page.*

Note: Air circulation is important to decomposition, thus the best compost bin is one with wire or screen sides. **Mass** is also important, since approximately one cubic yard of compost is needed to generate good decomposition temperatures (104°-170° F). Thus, an aquarium, with its small size and glass sides, is not the best compost container. Consider constructing an outdoor compost pile with wire sides on the school grounds. For instructions on outdoor composting, refer to Department of Natural Resources publication, "The Complete Composter" at www.dnr.wi.gov/org/aw/wm/publications/recycle/PUBWA182-05.pdf.



9. Observe: Which materials break down the fastest? Slowest? Why? Are there any odors? Why do you think decomposition has an odor? Does the texture of the compost change? In what ways? Once the materials in your compost pile have decomposed into humus, conduct the same feel, smell and look test that you did in Part 1, #2.

10. Now decide what your class should do with this rich soil. When you clean out the aquarium, should you dump the humus in the trash; take it outside and dig it into the soil; or use it for growing plants in the classroom?

11. Discuss: How does composting reduce the amount of waste you would have thrown out? What do you think happens to organic wastes that end up in the landfill? Is the landfill a gigantic natural compost pile, or are there problems with placing large amounts of organic material in landfills? (no air, limited moisture, etc.)

12. Now that you have constructed and maintained a mini-compost pile in the classroom, how would you go about constructing and maintaining one at home?

Pre- and Post-Activity Questions:

1. What are the necessary "ingredients" for a good compost pile?
2. How is composting related to the concept of recycling?
3. How can composting reduce waste?

GOING BEYOND

1. Create a compost pile as in Part 2, but also add manufactured items like a soda can, paper clip, bottle cap, aluminum foil, iron nail, pencil, crayon, paper, plastic bag, rubber band, etc. Predict rates of decomposition or lack of decomposition and observe actual changes, if any.
2. Take a field trip to a local woods or park. Examine a rotting log or leaf litter. Place a sample of rotting humus in a white enamel pan and sort through it carefully, looking closely for "decomposers." What decomposers (insects, mites, fungi, etc.) can you find? What do you think they are doing? Read about their life histories.
3. Make a worm composter. (for more information on worm composting, see DNR publication "The Complete Composter" at www.dnr.wi.gov/org/aw/wm/publications/recycle/PUBWA182-05.pdf and DNR website Environmental Education for Kids (EEK!) Composting www.dnr.wi.gov/eek/recycle/composte_waste.htm and Composting with Worms dnr.wi.gov/eek/earth/recycle/compost2.htm.
4. Visit someone who maintains a compost pile. Why do they compost? What do they do with the compost? Have they had any problems? Would they recommend composting?
5. Investigate what happens to the leaves your community discards each autumn. What do you think should be done with them?
6. If your community has a municipal composting center, take a field trip to it. Be sure to prepare questions to ask the guide.
7. Have students design experimental compost piles. For example, make a pile that is low in nitrogen; lacks moisture; has little air circulation; or is made of a single ingredient (e.g., just grass clippings). Also create a good compost pile for comparison. Compare rates and temperatures of decomposition between piles.
8. Fill flower pots with different soil types, including one type that has your humus mixed in. Plant seeds or grow seedlings in the pots. Make 4-5 pots with each soil type so that you're comparing more than one plant grown in each type (i.e., so that you have a large enough sample size to make a valid judgment). Do the plants in different soil types grow at different rates, with different vigor, color, etc? What are possible explanations for any differences?